

**POLAR ICEBREAKERS IN A CHANGING WORLD:  
AN ASSESSMENT OF U.S. NEEDS**

Statement of

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and  
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Committee on Transportation and Infrastructure  
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Good afternoon Mr. Chairman, Members of the Subcommittee, and staff: Thank you for inviting me to speak to you today about the current and future roles of the U.S. Coast Guard in U.S. polar icebreaking operations and to explain the importance of this function to national needs.

My name is Anita K. Jones and I am here in my capacity as Chair of the National Academies Committee to Assess U.S. Coast Guard Polar Icebreaker Roles and Future Needs. Our Committee was asked to provide a comprehensive assessment of polar icebreaker missions, how these missions might change over time, and how we can reliably meet all national needs given the state of our icebreaker fleet. I will be presenting the results of our just-completed study, “Polar Icebreakers in a Changing World: An Assessment of U.S. Needs.”

The United States has enduring national and strategic interests in the Arctic and Antarctic and the importance these regions is growing with time. In the north, the United States has territory and citizens above the Arctic Circle, creating significant national interests. In the south, the United States maintains three year-round scientific stations to assert U.S. presence and assure U.S. leadership among the nations that are signatories to the Antarctic Treaty. The United States uses that leadership to ensure that the Antarctic Treaty area, comprised of all land and waters below 60 degrees south latitude, are preserved for peaceful purposes and scientific research.

Antarctica is an ice-covered continent surrounded by an ocean, parts of which are seasonally ice-covered. The central Arctic Ocean is perpetually ice-covered and in the winter ice extends along the northwestern Alaskan coast and south through the Bering Strait. Asserting national interests and achieving national purposes in both polar regions requires polar icebreakers, ships capable of operating in a variety of challenging ice conditions. Over the past several decades, the U.S. government supported its polar interests with a fleet of four icebreakers. Three of these, including the world’s most powerful non-nuclear icebreakers, POLAR SEA and POLAR STAR, and the modern research icebreaker HEALY, have been operated by the U.S. Coast Guard. These three ships are designed to support U.S. Coast Guard missions and to support science: we refer to these as “multi-mission” ships as opposed to single mission vessels. The National Science Foundation (NSF) leases a fourth ship that has limited icebreaking capabilities and is dedicated entirely to Antarctic research—a single mission. Today, the POLAR STAR and the POLAR SEA are at the end of their designed service lives of 30 years.

As directed by Congress, the U.S. Coast Guard requested the National Research Council of the National Academies to convene the Committee on the Assessment of U.S. Coast Guard Polar Icebreaker Roles and Future Needs. The Committee was asked to provide a comprehensive assessment of the current and future roles of U.S. Coast Guard polar icebreakers. The Committee was asked to analyze any changes in roles and missions of polar icebreakers in the support of all national priorities, including consideration of ongoing and predicted environmental change and to assess whether changes to the existing laws governing the U.S. Coast Guard polar icebreaking operations are needed to address potential new missions and new operating regimes.

### **ICEBREAKING NEEDS IN THE ARCTIC**

During winter, the entire Alaskan northern coast and a substantial portion of the

Alaskan western coast is ice-bound. In summer the Arctic sea ice margin retreats northward, although not uniformly or predictably, usually creating open waters along the entire coastline for several weeks to several months. Summer sea ice extent is expected to continue to retreat over the next several decades, creating more broken ice along the Alaskan coastline.

Economic activity is predicted to increase and move northward as a result of sea ice retreat. Those deploying fishing fleets, cruise ships, mining and the associated ore transit ships, as well as petroleum recovery and tanker ship transport anticipate increased operations in the region. When current orders for ice-strengthened tankers have been filled, the world wide fleet of these vessels will double in number. Ice retreat increases the cost-effectiveness of using the Northern Sea Route (primarily north of Russia) and the Northwest Passage (primarily north of Canada) for transporting petroleum, ore, and cargo. Both routes include U.S. Arctic waters.

The potential for increased human activity in northern latitudes will likely increase the need for the United States to assert a more active and influential presence in the Arctic to protect not only its territorial interests, but also to project its presence as a world power concerned with the security, economic, scientific and international political issues of the region.

Possible ratification of the U.N. Convention on the Law of the Sea implies that the United States would require extensive mapping of the U.S. continental shelf off Alaska, should the United States wish to use Article 76 in the Convention to extend its continental shelf beyond the 200 nm economic zone and/or to counter territorial claims by other Arctic nations.

More variable and less predictable weather and sea ice conditions now occur in the Arctic. Both have made it more difficult for indigenous populations to predict when to initiate and terminate the culturally-important, annual whale hunt, as well as when it is safe to travel over coastal ice or hunt further from shore.

Over the past decades the U.S. Coast Guard has not conducted routine patrols in ice-covered waters due to a lack of funding. The growing human presence and increased economic activity in the Arctic will be best served by reinstating patrols in U.S. coastal waters and increasing U.S. presence in international waters of the north. To assert U.S. interests in the Arctic, the nation needs to be able to access various sites throughout the region at various times of the year, reliably and at will. While the southern extent of the Arctic ice pack is thinning and becoming less extensive during the summer, there is no question that polar icebreakers will be required for many decades for egress to much of the Arctic basin. Ice conditions in the U.S. Arctic are among the most variable and occasionally challenging through the circum-Arctic. National interests require icebreakers that can navigate the most formidable ice conditions encountered in the Arctic.

**Recommendation #1: The United States should continue to project an active and influential presence in the Arctic to support its interests. This requires U.S. government polar icebreaking capability to assure year-round access throughout the region.**

## ICEBREAKING NEEDS IN THE ANTARCTIC

Multiple national policy statements and Presidential Decision Directives have reaffirmed the importance of an “active and influential” U.S. presence in Antarctica in support of U.S. leadership in the Antarctic Treaty governance process and as a geopolitical statement of U.S. world wide interests. The United States is committed to preserving Antarctica exclusively for peaceful purposes, furthering scientific knowledge, and preserving and protecting one of the most pristine environments on the globe.

The U.S. presence in Antarctica is principally established by the year-round occupation of three stations: McMurdo, Palmer, and South Pole. This presence secures the United States’ influential role in the Treaty’s decision-making system and maintains the political and legal balance necessary to protect the U.S. position on Antarctic sovereignty. Many view the permanent year-round presence of the United States as a major deterrent to those countries that might otherwise wish to exercise their overlapping territorial claims. Thus, scientific activity in the Antarctic is an instrument of foreign policy.

The U.S. research presence in Antarctica currently relies on ship-borne resupply with the majority of fuel and cargo for the U.S. Antarctic Program delivered to McMurdo Station by tanker and container ship. Fuel and supplies are ferried from McMurdo to the South Pole Station and remote field sites by aircraft or overland traverse. Multiple studies over the years have repeatedly confirmed that the safest and most cost-effective means of transporting the necessary quantities of fuel and cargo to McMurdo Station is by ship.

Presently two ice-strengthened ships chartered by the Military Sealift Command transport cargo and fuel and remove refuse. These ships *require* icebreakers to open a shipping channel through the shore-fast ice to McMurdo Station, which has been up to 80 miles long, and to provide close escort to and from the ice pier. During the past six years, the break-in through McMurdo Sound has become increasingly more challenging. Until 2006, large icebergs in the Ross Sea have blocked wind and currents from clearing the ice from McMurdo Sound, and the blockage has increased the amount of harder, thicker, multi-year ice in the Sound. The last six seasons have generally required two icebreakers to break and groom the channel and escort the transport ships through the channel.

For the past couple of years, because the condition of the POLAR STAR and POLAR SEA has required increased maintenance as they near the end of their service lives, the National Science Foundation contracted the services of the Russian icebreaker KRASIN. Approximately the same age as POLAR STAR, KRASIN assisted the POLAR STAR in 2005 and in early 2006 conducted the break-in alone but broke a propeller blade (which a U.S. Navy diving and salvage team could not repair) before escorting the tanker and container ship through difficult ice conditions. The POLAR STAR was dispatched from Seattle, where it was in stand-by status. The KRASIN was able to escort the tanker to the pier, and when re-fueling of the McMurdo tank farm commenced, only five days of fuel remained. These events highlight the difficult ice conditions, the aging condition of the two U.S. icebreakers powerful enough to perform the McMurdo break-in, and the condition of icebreakers that can be chartered on the open market. These circumstances make future resupply missions vulnerable to failure.

While there is ongoing discussion of the possibility of being able to store enough fuel and supplies to skip a resupply in a given year, the fact remains that the United States

will need the ability to break a channel and resupply McMurdo Station by ship in any given year. This reality requires reliably-controlled icebreaker capability that can be assured over decades. Annual charter—commercial or from another nation—provides insufficient assurance of successful resupply for the long term.

The Committee concludes that for the purposes of the single mission of McMurdo resupply, the icebreakers do not necessarily need to be operated by the U.S. Coast Guard, but to best meet mission assurance requirements they should be U.S. flagged, U.S. owned, and U.S. operated. Without specific proposals it is difficult to evaluate the cost-effectiveness or the possibility that other nations might partner to invest in a Polar class icebreaker with the United States.

Ice conditions will be increasingly difficult until a considerable portion of the multi-year ice in the Sound is removed by natural processes. For the foreseeable future, two polar icebreakers will be needed to support the resupply mission at an acceptable level of risk. U.S. icebreaking assets must be sized to handle the most difficult ice conditions in McMurdo Sound.

**Recommendation #2: The United States should continue to project an active and influential presence in the Antarctic to support its interests. The nation should reliably control sufficient icebreaking capability to break a channel into and assure the maritime resupply of McMurdo Station.**

## **SUPPORT OF U.S. POLAR RESEARCH**

The history of polar research is directly tied to the geopolitical circumstances following World War II and the subsequent Cold War era. In the South this was evidenced by the deployment of nearly 3,000 personnel to Antarctica in the United State's commitment to the International Geophysical Year (IGY) in 1957-1958. While polar research was seen as important, it also provided a mechanism to project U.S. global presence and power in a manner that served U.S. interests. Construction of the Distant Early Warning (DEW) Line radars looking toward the former Soviet Union necessitated a year-round presence, creating a need for a better understanding of the Arctic environment and improvement in our ability to work and live in the extreme cold. The establishment of research facilities in Barrow was an outgrowth of the political and military necessities of the time.

Fundamental advances resulting from polar research have directly benefited society. Polar research led to the identification of the presence and cause of the “ozone hole,” and has resulted in coordinated world wide actions to discontinue the use of chlorofluorocarbons. Understanding how the polar regions affect ocean circulation is leading to a better understanding of global climate. The study of Weddell seals, which dive to great depths and cease breathing for long periods, led to better understanding of how such mammals handle gas dissolved in blood during and after deep diving events. This contributed to advances in understanding Sudden Infant Death Syndrome (SIDS). The study of mammals, insects, and plants that endure freezing temperatures, yet prevent the formation of ice crystals in their internal fluids, is aiding in the design of freeze-resistant crops and improved biomedical cryo-preservation techniques.

The Arctic and Antarctic are natural laboratories whose extreme, relatively pristine environments and geographically unique settings enable research on fundamental

phenomena and processes that are feasible nowhere else. Today, researchers seek a better understanding of how new ocean crusts form, how organisms adapt to the extremes of temperature and seasonality (light conditions), how ice sheets behave, and how the solar wind and the earth interact. Unexplored, subglacial lakes in the Antarctic that have been sealed from the atmosphere for millions of years are soon to be explored and entered. Beneath the South Pole Station a cubic kilometer of clear ice is being instrumented with 5,000 detectors to observe high-energy neutrinos that may tell us about phenomena such as supernovae. Pristine ice cores that span centuries give direct data about temperature changes and atmospheric gas concentrations in the past.

As global climate has garnered world wide attention, the polar regions have been found to react acutely to fluctuations in climate and temperatures. The 40 percent reduction in Arctic sea ice thickness over the past four decades is one of the most dramatic examples of recent changes. As ice tends to reflect solar radiation and water absorbs it, melting in the polar regions can exert a strong influence on both atmospheric climate and ocean circulation. Huge reservoirs of water are held in massive ice sheets and glaciers; substantive release may create major climate and social dislocations. Thus, research in these regions plays a pivotal role in the global earth system exerting influences of critical importance. Scientists have declared 2007-2008 to be the International Polar Year. Multi-national collaboration and new polar research activities are planned.

The health and continued vitality of polar research is intimately linked to the availability of the appropriate infrastructure and logistical support to allow scientists to work in these harsh environments. Access to the polar regions is essential if the United States is to continue to be a leader in polar science. To operate reliably and safely in these regions necessitates a national ice-breaking capability. Icebreakers enable resupply to land-based stations and field camps in the south. Availability of polar icebreakers with greater icebreaking capability would enable important new research in the southern ocean in locations where ice is thick. While other assets and platforms such as airplanes and space-borne sensors are useful tools, surface ground-truth and *in situ* sampling will not be replaced in the near future. Because there are no land sites in the central Arctic, an icebreaker is an essential platform to support sustained scientific measurements in the Arctic Ocean. The availability of adequate ice-breaking capabilities will be essential to advancing research in both polar regions.

**Recommendation #3: The United States should maintain leadership in polar research. This requires icebreaking capability to provide access to the deep Arctic and the ice-covered waters of the Antarctic.**

### **RENEWAL OF THE NATION'S POLAR ICEBREAKING FLEET**

Projecting an active and influential presence in the polar regions requires that the United States be able to access polar sites at various times of the year to accomplish multiple missions, reliably and at will. Air borne, space borne and submarine assets can only partially address these missions. The presence of surface ships in ice-covered waters is necessitated by geopolitics. In recent correspondence to this Committee, the Department of State, Department of Defense, and Department of Homeland Security further validated that icebreaking capability is necessary to protect national interests in

the polar regions. Thus, the United States requires ships that can assure access through thick multi-year ice in the northern and southern polar regions. Based on these broad missions, the Committee believes that the core of the icebreaking fleet must be the multi-mission ships operated by the U.S. Coast Guard, a military organization.

The current sea-going U.S. fleet of four ships includes three multi-mission ships operated by the U.S. Coast Guard and one ship, the PALMER, dedicated to scientific research and appropriately operated by the NSF. One of the three multi-mission ships, the HEALY, was commissioned in 1999 and its performance has exceeded design specifications. The HEALY's operating time is dedicated to the support of Arctic research. While capable of performing many additional U.S. Coast Guard missions including search and rescue, sovereignty, presence and law enforcement, the HEALY cannot independently operate in the ice conditions of the Central Arctic and McMurdo Sound. The HEALY was built to complement the Polar class ships.

The two polar icebreakers in today's U.S. icebreaker fleet are at the end of their 30-year designed service lives. Over the last decade, some routine maintenance has been deferred due to a lack of funds, and no major life extension program has been planned to extend their service. As a consequence U.S. icebreaking capability is today at risk of being unable to support national interests in the north and the south.

This Committee believes that the nation continues to require a fleet that includes a minimum of three multi-mission ships. This conclusion is consistent with the findings of an earlier study, the 1984 United States Polar Icebreaker Requirements Study conducted by U.S. Coast Guard, Office of Management and Budget, NSF, National Oceanic and Atmospheric Administration, Department of Defense, Maritime Administration, and Department of Transportation. It is also consistent with a 1990 Presidential Report to Congress that reiterated that polar icebreakers were instruments of national policy and presence and that three [multi-mission] polar icebreakers were necessary to meet the defense, security, sovereignty, economic, and scientific needs of the nation (together with a fourth, dedicated research ship, the PALMER). The Committee agrees with the findings of the two previous reports. In addition, the Committee notes that icebreaking needs have increased since 1990 and will continue to increase into the foreseeable future. This projected increased demand is a direct effect of a changing climate facilitating increased human presence in the Arctic.

Although the demand for icebreaking capability is predicted to increase, the Committee believes that the application of the latest technology, creative crewing models, wise management of ice conditions, and more efficient use of the icebreaker fleet and other assets can be used to meet increased requirements while maintaining the number and configuration of the icebreaker fleet the same as today—two Polar class ships, HEALY and PALMER. The demand for icebreaking capability in support of research is also increasing. Increasing science requirements will likely be met by a more capable replacement for the Palmer to conduct Antarctic research, and by a planned ice-strengthened Alaskan Region Research Vessel for light ice conditions in the Arctic. The Committee concluded that the demand of the science community for dedicated research vessels with a variety of ice breaking capabilities will greatly increase in both polar regions. When used in conjunction with the polar icebreakers, research ships will be able to venture into waters that they alone could not safely transit, maximizing the return on the nation's investment in science and the ice breaking fleet.

One new polar icebreaker is insufficient for several logical reasons. First, a single ship cannot be in more than one location at one time. No matter how technologically advanced or efficiently operated, a single polar icebreaker can be operational (on station) in the polar regions for only a portion of any year. An icebreaker requires regular maintenance and technical support from shipyards and industrial facilities, must re-provision regularly, and needs to effect periodic crew change-outs. These functions cannot be conducted practically or economically “in the ice” and therefore require transit time to and from polar operating areas. A single icebreaker, therefore, could not meet any reasonable standard of active and influential presence, and reliable, at-will access throughout the polar regions.

A second consideration supporting the need for more than a single polar icebreaker is the potential risk of failure in the harsh conditions of polar operations. Icebreakers are the only ships designed to collide regularly with hard objects, and to go independently where no other surface vessels can survive. Despite their intrinsic robustness, damage and system failure are always a risk, and the U.S. fleet must have enough depth to provide back-up assistance. Being forced to operate with only a single icebreaker would necessarily require the ship to accept a more conservative operating profile, avoiding more challenging ice conditions because reliable assistance would not be available. A second capable icebreaker, either operating elsewhere or in homeport, would provide assured back-up assistance and would allow for more robust operations by the other ship.

From a more strategic, longer-term perspective, two new icebreakers will far better position the nation for the increasing challenges emerging in both polar regions. Building two new icebreakers will assure maintenance of this level of capability. A second new ship would allow the U. S. Coast Guard to re-establish an active patrol presence in U.S. waters north of Alaska to meet statutory responsibilities that will inevitably derive from increased human activity, economic development, and environmental changes. Other unplanned situations can include search and rescue cases, pollution incidents where initial response and U.S. Coast Guard monitoring is necessary, and assistance to ships threatened with grounding or damage by ice. The likelihood of these situations will increase as the number of ice-strengthened tankers, tourist ships, and other vessels in the polar regions grows.

Moreover, a second new ship will leverage the possibilities for simultaneous operations in widely disparate geographic areas (such as concurrent operations in the Arctic and Antarctic), open additional solutions for conducting Antarctic logistics, allow safer multiple-ship operations in the most demanding ice conditions and areas, and increase opportunities for international expeditions. Finally, an up-front decision to build two new polar icebreakers will allow economies in the design and construction process, and provide a predictable cost reduction for the second ship.

The Committee was asked to consider alternative ship ownership options. Considering the McMurdo break-in mission alone, the Committee found that to best meet mission assurance requirements, only a U.S. flagged, U.S. owned, and U.S. operated ship provides sufficiently reliable control. While that ship might be leased commercially through a long-term lease/build arrangement, from a total fleet perspective it may be more cost-effective if science mission users only pay incremental costs—as has been the case in the past—and if the U.S. Coast Guard provides McMurdo resupply support from

the multi-mission icebreaker fleet. Also, the sovereign presence of the United States is not well served by a “leased ship.” Lease arrangements do not assure that the United States could assert its foreign policy will at times and places of its choosing.

The Committee concludes that the research support mission and other U.S. Coast Guard missions can be, in many cases, compatibly performed with a single ship. The two existing polar class ships and the HEALY are equipped to support research and have productively served that mission. The Committee believes that it is advantageous to configure the U.S. Coast Guard ships with appropriate science facilities as well as for the U.S. Coast Guard’s more general missions. In the long run, constituting the nation’s icebreaking fleet as a single fleet of complementary ships will yield more capability and should be more cost-effective than if each agency independently acquires icebreaking ships. This approach is in line with the long held belief that the nation can gain the greatest economy from the sharing of assets across agencies and programs when appropriate and feasible and those users should share in the incremental increase in cost associated with directed usage of national assets.

The Committee was asked in what manner to acquire ships. The benefits of constructing a new ship were compared to overhauling and extending the life of POLAR STAR or POLAR SEA. A so-called service life extension program (SLEP) involves wholesale replacement of the propulsion plant and auxiliary, control and habitation support systems. While the cost of a new hull could be avoided, the retrofit of most systems would be costly and limited by the constraints of the existing hull. The Committee recommends new construction for several reasons. There is effective, new technology, particularly new hull designs that could not be retrofitted to an existing ship. The hull and ship interior structure limit retrofit design choices, thus diminishing capability. We estimate that a SLEP would likely cost at a minimum more than half of a new construction cost. Some SLEP programs have overrun their budgets and have cost as much as construction of a new ship. A newly designed ship would also meet more stringent environmental standards than the current ships.

**Recommendation #4: National interests in the polar regions require that the United States immediately program, budget, design, and construct two new polar icebreakers to be operated by the U.S. Coast Guard.**

### **TRANSITION TO A NEW POLAR ICEBREAKING FLEET**

It is expected that the new polar icebreakers will not enter service for another 8 to 10 years until the program, budget, design, construction, and test phases are completed. During this time the United States needs a transition strategy to assure a minimum level of icebreaker capability. The Committee recommends a continuing maintenance and repair program for the POLAR SEA, building on the work recently completed, to keep it mission capable until at least the first new polar ship enters service. The cost to keep this ship mission capable will be much less than a service life extension program. The resulting capability, an upgraded POLAR SEA and a fully capable HEALY, is less than this Committee believes the nation needs, but a cost-effective strategy should emphasize new construction rather than maintenance of aging ships. The nation may have to charter supplemental ship services during the transition to new ships. The Committee also advises that the POLAR STAR continue to be kept in caretaker status, indefinitely

moored at the U.S. Coast Guard pier. If the POLAR SEA has catastrophic problems, the POLAR STAR could be reactivated and brought back into service within a year or so.

This transition strategy carries risk, and that risk comes from a decade of inaction. The strategy would permit the United States to locate an icebreaker (POLAR SEA and HEALY) in each polar region as needed. The two ships could leverage each other, for example on a central Arctic mission, or in McMurdo Sound. The NSF may need to supplement the POLAR SEA with a commercial or internationally chartered ship when the McMurdo break-in is particularly difficult as is expected in the coming year. This strategy is not ideal, and it carries significant risk, but due to the long lead-time for new ships there are no alternatives.

Execution of this transition strategy has already commenced. The POLAR SEA completed sea and ice trials in August, 2006 after undergoing repair work at a cost of approximately \$30 million.

Keeping the POLAR SEA mission capable to roughly 2015 will require further investment in maintenance and system renewal. The U.S. Coast Guard should determine the best way to do this work. One strategy is for the POLAR SEA to be taken out of service for a year of shipyard work around 2012, at a cost of roughly \$40 million. An alternative maintenance strategy that avoids having the POLAR SEA out of service for a year is to perform the work in increments year-by-year when the ship is in port. Careful planning would be required for the U.S. Coast Guard to determine which upgrade strategy is better. (This report discusses these issues in more detail in chapter 10.) By 2012 the NSF may be prepared to skip the McMurdo resupply for one year, or the NSF might arrange for an alternative icebreaker to perform the break in during a year that the POLAR SEA is in the shipyard.

**Recommendation #5: To provide continuity of U.S. icebreaking capabilities, the POLAR SEA should remain mission capable and the POLAR STAR should remain available for reactivation until the new polar icebreakers enter service.**

## **MANAGING THE NATION'S POLAR ICEBREAKING FLEET**

Both icebreaker operations and maintenance of the polar icebreaker fleet have been underfunded for many years. Deferring long-term maintenance and failing to execute a plan for replacement or refurbishment of the nation's icebreaking ships have placed national interests in the polar regions at risk. The recent transfer of budget authority for the polar icebreaking program by the Office of Management and Budget from the U.S. Coast Guard to the NSF did not address the basic problem of underfunding routine maintenance or providing funds for U.S. Coast Guard non-science icebreaker missions. The transfer has increased management difficulties by spreading management decisions across two agencies and multiple congressional oversight committees.

The NSF now has fiscal control over direct costs associated with the polar icebreaking program, including personnel, training, operations, and maintenance. The NSF is now fiscally responsible and making decisions for missions outside its core mission and its expertise. The U.S. Coast Guard is operating a ship for which it does not have full budget and management control.

The Committee believes that the total set of U.S. Coast Guard icebreaking missions transcends the mission of support to science, despite the fact that the majority of

icebreaker usage at the current time is to support research. The U.S. Coast Guard should have the funds and authority to perform the full range of mission responsibilities in ice-covered waters of the Arctic. This will require resumption of regular patrols of coastal waters and an increased U.S. presence in international Arctic waters by the nation's multi-mission icebreaker fleet.

It is not sufficient to provide funds to only maintain the fleet; it is necessary to provide funds to effectively operate it. The Committee strongly believes that management responsibility should be aligned with management accountability.

When the NSF, NOAA, or another "user" agency employs a U.S. Coast Guard icebreaker to support some directed activity, the user agency should pay incremental operational costs associated with direct mission tasking. This arrangement has worked well for decades, though it would be useful for the financial arrangement to be clarified and reasserted by the Administration. If the U.S. Coast Guard is funded to operate a vessel, then direct tasking reimbursement would typically include the cost of fuel for extended transit beyond patrol, and on-ship engineering and habitation costs that derive from research activities. The Committee encourages the U.S. Coast Guard to invite researchers and educators on planned patrols to conduct science of opportunity. Only the former, direct tasking, should require reimbursement to the U.S. Coast Guard above congressionally appropriated operational funds.

**Recommendation #6: The U.S. Coast Guard should be provided sufficient operations and maintenance budget to support an increased, regular, and influential presence in the Arctic. Other agencies should reimburse incremental costs associated with directed mission tasking.**

### CLARIFY NATIONAL POLICY

The U.S. need for polar icebreaking has been studied several times over the past two decades. The conclusions remain the same. As a nation with citizens in both the Arctic and Antarctic, the United States has a clear obligation to assure the welfare of these citizens and to protect its national interests in the polar regions. The U.S. Coast Guard polar icebreaker fleet is a national asset that is best managed to serve multiple missions.

The last declaration of Presidential-level policy regarding the U.S. requirements for polar icebreaking was a Presidential Report to Congress in 1990. While recognizing the continuing national need for polar icebreaker operations, this report does not adequately address current and future issues.

Immediate policy action is needed for several reasons: wholesale ship obsolescence in the fleet; lack of adequate U.S. Coast Guard capability in the Arctic; increased human presence and economic activity in the Arctic region; and threats to native American communities due to accelerating environmental changes. Clear direction for sustaining icebreaking capabilities needs to be asserted to ensure that the United States does not find itself without adequate polar icebreaking capability in the future as it has in the past and as it does today. If the multi-mission ships are to be used effectively as a national asset, then the agency with the core mission to support the polar icebreaking needs of the nation—the U.S. Coast Guard—must have adequate budgetary

authority and operational control of the fleet. The U.S. Coast Guard's full operational mission in the ice-covered waters of the Arctic needs to be re-affirmed.

**Recommendation #7: Polar icebreakers are essential instruments of U.S. national policy in the changing polar regions. To assure adequate national icebreaking capability into the future, a Presidential Decision Directive should be issued to clearly align agency responsibilities and budgetary authorities.**

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